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AUTHOR Gozali, Harriet Seid; And Others
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ABSTRACT

The purpose of this study was to explore the relationship between the Internal External (I-E) control construct and time utilization on a test of verbal ability. A total of 148 college students participated in the study, 63 of whom were assigned to the experimental group. All subjects took two tests: the I-E Scale, and a multiple choice test of verbal ability, which also provided a measure of time utilization. Results included: (1) support of the hypothesis that Internals would use time in a manner more appropriate to the task than would Externals; and (2) the hypothesis that Externals would be more variable than Internals in the amount of time spent at all levels of item difficulty was not supported. Actually, Internals were more variable than Externals in the amount of time spent on items. A total of two additional analyses were performed post hoc in order to examine the possibilities that the findings reflected ability differences or sex differences rather than Internal-External differences. Ability was eliminated as a confounding variable. The analysis of sex differences indicated that not blocking on sex had a dampening effect on the results. (KJ)

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Harriet Seid Gozali, T. Anne Cleary, and G. William Walster

University of Wisconsin

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Introduction

Background

An intriguing finding of the Coleman Report (1966) is that, among disadvantaged students, there is a high correlation between achievement and sense of control over the environment.

The control concept, known as Internal versus External control of reinforcement, was originally introduced by Julian Rotter in his Social Learning Theory. The concept refers to the degree of perceived control over one's environment. At one end of the continuum is Internal control, the perception that outcomes are a consequence of one's actions. At the other end of the continuum is External control, the perception that outcomes are in the external hands of fate, luck, and powerful others and, therefore, are beyond personal control.

Explanation of the relationship that Coleman identified, between sense of control and achievement, thus far has been only speculative, and the present study was undertaken in order to explore it further. It was reasoned that Internals may use specific identifiable test-taking strategies that result in their obtaining higher achievement test scores

than do Externals. The particular test-taking behavior of interest in this study was time utilization.

The first hypothesis of interest was that Internals would use time in a manner more appropriate to the task than would Externals; that is, they would spend less time on easy items and more time on difficult items, while Externals would not use time in a manner systematically related to the task. The second hypothesis was with respect to the variability of time spent. It was hypothesized that Externals would be more variable than Internals in the amount of time spent at all levels of item difficulty.

Review of Related Research

Research concerning the Internal-External control construct generally has used scores on the I-E Scale, developed by Rotter (1966), to characterize individuals along this dimension.

This scale is a paper and pencil test comprised of 29 forced-choice items, six of which are fillers. Each item requires the respondent to choose the statement that is the more true for him. For example, on one item, response (a) reads, "Many times I feel that I have little influence over the things that happen to me," and response (b) states, "It is impossible for me to believe that chance or luck plays an important role in my life."

The I-E Scale has shown relationships to a variety of behaviors. There is some indication that Internals, as compared with Externals, more actively seek information relevant to problem solving (Davis and Phares, 1967), tend to retain more information when this information is relevant to personal goals (Seeman, 1963; Seeman and Evans, 1962), and

tend to better utilize information which has been equivalently acquired and retained by Internals and Externals (Phares, 1968). Internally controlled individuals also tend to be less conforming, in certain experimental conditions (Odell, 1959; Crowne and Liverant, 1963).

Several studies report a relationship between I-E and socio-economic status. Except among college samples, high SES is associated with Internal control, low SES with External control; and low SES Negroes were found to be the most Externally oriented group (Gore and Rotter, 1963; Franklin, 1963; Battle and Rotter, 1963; Lefcourt and Ladwig, 1965; Graves, 1966). Among adults, I-E is unrelated to intelligence (Rotter, 1966; Hersch and Scheibe, 1967). College students tend to be Internal, with I-E mean scores ranging from 7.73 to 9.22 (Rotter, 1966; Phares, 1968; Phares, Ritchie and Davis, 1958; Lefcourt, Lewis and Silverman, 1968; Julian and Katz, 1968). Among Negro college students, commitment to effecting social change was found to be associated with Internal control (Gore and Rotter, 1963; Strickland, 1965).

Coleman (1966) found that sense of control over the environment was the best single predictor of Negro students' academic achievement. The unique contributions of this variable to accounted for variance in verbal achievement were 6.93, 12.30, and 7.88 percent respectively for sixth, ninth and twelfth grade Negroes. Of the 100 some variables measured in the survey, sense of control over the environment,

> "for minority groups which achieve less well,...(is)...more strongly related than any other variable to achievement...The special importance of a sense of control of environment for achievement of minority-group children and perhaps for disadvantaged whites as well suggests a different set of predispositional factors operating to create low or high achievement for children from disadvantaged groups than for children from advantaged groups. For children from advantaged groups, achievement or lack of it appears closely related to their self-concept...For children from disadvantaged groups,

> achievement or lack of achievement appears closely related to what they believe about their environment: whether they believe the environment will respond to reasonable efforts, or whether they believe it is instead merely random or immovable (pp. 320-321)."

The findings of the Coleman study were sufficiently contrary to the expectations of those interested in documenting that inequalities of school facilities are the educational variables relevant to inequalities of educational achievement that, as Daniel Moynihan (1968) stated, "the response of the Office of Education has now been carried to its logical conclusion: the Coleman report is out-of-print, and there is apparently no intention to reprint (p.24."

Of particular interest to the present investigation are studies in which the I-E dimension has been related to time utilization.

Rotter and Mulry (1965) found that Internals spent more time on an angle matching task when they were instructed that performance involved skill than they did if instructed that performance was a matter of luck. Externals tended to take longer under chance-controlled conditions than under skill-determined conditions, although these decision time differences were not statistically significant.

The effect of skill versus chance instructions on decision time also was investigated by Lefcourt, Lewis and Silverman(1968), using a level-of-aspiration task. They found no interaction between I-E and instructional condition. However, when subjects' perceptions of the nature of the task provided the skill-chance dichotomy, the interaction between I-E and skill versus chance was significant. Internals spent more time on the task when they perceived it to be skill-determined; Externals spent more time on the task when they perceived it to be chance-determined. Within the group who perceived the task to be skill-

determined, Internals had longer decision times than did Externals.

Julian and Katz (1968), using a synonym or antonym word pair identification task, found that Internals took longer to respond to items as the difficulty of the items increased. The difference in time spent by Externals on easy and difficult items was not significant. There were no differences between Internals and Externals in overall time.

Purpose

It was the purpose of this study to explore the relationship between the Internal-External control construct and time utilization on a test of verbal ability. It was hypothesized (a) that Internals would spend less time on easy items than on difficult items, while Externals' time utilization would not be systematically related to item difficulty; and (b) that Externals would be more variable than Internals in the amount of time spent at all levels of item difficulty.

Method

Subjects

148 college students enrolled at the University of Wisconsin comprised the sample. Subjects were randomly assigned to one of two groups. 63 subjects were randomly assigned to the experimental conditions designed to test the study's hypotheses. The other group of subjects, the calibration group, provided data used to establish item difficulty of the verbal ability test items. Subjects' participation was voluntary and without inducement of course credit or pay. Subsequent reference is to the 63 subjects, except when indicated otherwise.

Procedure

Testing was conducted at the University of Wisconsin Synnoetics Laboratory, which is a laboratory for research in computer-assisted instruction. Two subjects were scheduled for each hour of testing. Upon arrival, subjects completed a brief personal data form. All subjects took two tests: the I-E Scale, and a multiple choice test of verbal ability. The order in which these two tests were taken was randomly assigned.

The verbal ability test provided the measure of time utilization. This test was computer-administered, and computer-administration made it possible to unobtrusively collect latency data, since subjects' answer choice and response latency for each item were recorded automatically within the computer system.

Subjects took the computer-administered test in one of the laboratory's two terminals. In these terminals, the essential apparatus is a screen, on which test items on slides appear, and a typewriter, which types directions to the subject and which the subject uses to make responses. Responses are made by pressing the typewriter key whose number corresponds to the answer choice. Subjects were shown how to make corrections and how to skip items. The test was self-paced without a time limit; a new item did not appear until the subject pressed a key indicating that he had completed working on the item on the screen. It was not possible for subjects to return to previously answered items. A series of practice questions was used to illustrate the instructions with examples and to accustom the subject to the apparatus. When the subject indicated that he understood the instructions, the experimenter left the terminal. Written instructions were left with the subject.

Two experimenters monitored the test from a control room, by means of one-way glass and a telephone to the terminals. Records were kept of slide failures and other mechanical difficulties that introduced random error into the procedures.

Instruments

The verbal ability test consisted of 20 multiple choice items. These items were selected from a pool of items made available by Educational Testing Service. Items were selected to represent the range of difficulty, on the basis of item characteristics reported by ETS. Using the ETS difficulty index, the 20 items were ordered from easy to difficult, and the order of items was the same for all subjects.

While it is possible that order may confound the findings, it was considered desirable to preserve this easy-to-difficult order, since this is the item order common to achievement tests.

The I-E Scale is a 29 item forced-choice questionnaire, six items of which are fillers. Scoring commonly is done in the external direction, so that the higher the score, the more external the orientation. The range of possible scores is from 0 to 23. Test-retest correlations with college populations range from .55 to .83 and internal consistency coefficients range from .63 to .79 (Rotter, 1966). For two populations of University of Wisconsin educational psychology students, the test-retest correlations were .75 and .81, and the Hoyt coefficients were .75 and .73. For the 63 students who were subjects in the present study, the Hoyt coefficient of internal consistency was .79.

Analysis of Data

The I-E scores were used to form three cells, with 21 subjects in each cell. These cells were called the Internal group, the Middle I-E group, and the External group. The distribution of I-E scores and the scores used as cut-off points to form three groups are shown in Table 1.

The data were analysed with a multivariate analysis of variance, using orthogonal polynomial contrasts to test for linear and quadratic trends.

Following the procedure derived by Walster and Cleary (in press), two critical values of the test statistic were determined. The critical values determined were those values that, for a sample of 21 subjects each in three cells, would allow (a) for detecting as significant a difference of the hypothesized trends of 1σ or more, with a power of .90, and (b) for detecting as trivial a difference of $.1\sigma$ or less, with a probability of .80. The measurement unit σ is that of the underlying variability. The α levels of significance used were .05 and .18 for significant and trivial differences respectively.

Difficulty of items for this sample were established by means of a GITAP item analysis (Baker, 1969) of the 20 item verbal ability test data collected on the calibration sample. The resultant X_{50}'s (Baker, 1969) for the items were used as the item difficulty measures in computing the dependent measures.

Two dependent measures were computed from the latency data collected for each subject. The first dependent measure was the amount of the variance in latency accounted for by a linear relationship between

latency and item difficulty. This measure is given by the formula $\sigma_y^2 \rho_{xy}^2$, where σ_y^2 is the variance in latency, and ρ_{xy}^2 is the squared correlation between latency and item difficulty.

The first hypothesis was that, as item difficulty increased, Internals would spend increasingly more time on items, whereas Externals would not differentiate in amount of time spent as item difficulty increased. The first dependent measure provided the index of the linear relationship between latency and item difficulty. It was this measure, therefore, that was used to test the first hypothesis--that this index would be lowest for Externals and highest for Internals. In other words, the statistical hypothesis was that there would be a directional linear trend on this measure across the three I-E groups.

The second dependent measure was the amount of variance in latency that could not be accounted for by a linear relationship between latency and item difficulty. This measure is given by the formula $\sigma_y^2 (1 - \rho_{xy}^2)$, where σ_y^2 and ρ_{xy}^2 are defined as above.

The second hypothesis was that Externals would be more variable than Internals in their latencies. The second dependent measure provided the index of the non-linear relationship between latency and item difficulty. It was this measure that was used to test the second hypothesis--that this index would be highest for Externals and lowest for Internals. Once again, the statistical hypothesis was that there would be a directional linear trend across the three I-E groups on this measure, with the direction the reverse of that of the first hypothesis.

The hypothesized trends are illustrated as figures 1, 2, and 3.

Results and Discussion

The cell means on the two dependent measures are given in Table 2. These are means of the variance in latency accounted for by a linear relationship between latency and item difficulty and means of the variance in latency not accounted for by a linear relationship between latency and item difficulty. These means show the trends on the two dependent measures. The relationship between latency and item difficulty, obscured by the dependent measures, is clearly indicated by the correlation between these two variables: the correlation between latency and item difficulty, for individuals, ranged from 0 to .45. For one-third of the sample, this correlation was less than .08; for one-third of the sample, this correlation was greater than .20.

The analysis of variance tables for the two dependent measures are presented as Tables 3 and 4. The test of linear trend on both dependent measures yielded a multivariate $F = 2.4788$, d.f. = 2.59, $p < .09$.

The first hypothesis was supported (univariate $F = 4.9391$, d.f. = 1,60, $p < .03$). The more Internal the orientation, the stronger the linear relationship between latency and item difficulty. In other words, the I-E dimension is informative in predicting time utilization; Internals do use time in a manner more appropriate to the test-taking situation than do Externals.

The second hypothesis was not supported (univariate $F = 1.9826$, d.f. = 1,60, $p < .16$), and the direction of the linear trend was the reverse of that predicted. That is, Internals were more variable than Externals in the amount of time spent on items.

The study, then, offers another validation of the I-E construct, and it adds to the knowledge that achievement tests measure more than intellective variables. Most achievement tests have a time limit, and good use of time is important to test performance. Two individuals of equal achievement level may obtain different achievement test scores as a function of their I-E dispositions.

Test-wiseness generally is acknowledged as having an effect on test performance. This study suggests the usefulness of a personality dimension in predicting one component of test-wiseness, that of time utilization. Another component of test-wiseness that may be investigated fruitfully in the same manner is guessing behavior. Concern with improving achievement emphasizes instruction in subject matter. It may also be of value to teach the appropriate use of resources other than subject matter resources that are relevant to performance. While improvement in achievement scores that might result from such instruction is not improved achievement, such improvement would at least reduce the errors of mistaking as low achievement what is partially something else.

Two additional analyses were performed post hoc in order to examine the possibilities that the findings reflected ability differences or sex differences rather than I-E differences.

Undergraduate grade point average provided the measure of ability. Means for External, Middle I-E, and Internal groups respectively were 3.3, 2.9, and 3.2, on a scale with a low-to-high range of 0 to 4. This finding, while a puzzling one, does eliminate the possibility that ability was a confounding variable.

The analysis of sex differences indicated that not blocking on sex had a dampening effect on the results. Figure 4 shows that the linear trend of the first hypothesis was present for both males and females. It further illustrates that this trend was stronger for females than for males. The means on the first dependent measure were higher for females than for males in all three cells. There were 13 females and 8 males in the External group, so that this cell mean was elevated by the females' scores. There were 5 females and 16 males in the Internal group, so that this cell mean was lowered by the males' scores. Had there been an equal number of males and females in each cell, the obtained results would have been considerably stronger.

This study used a relatively homogeneous sample, in terms of race, I-E, and achievement. It is suggested that with a group more heterogeneous on these variables, more striking findings may be anticipated.

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TABLE 1

Distribution of I-E Scale Scores and I-E Cell Grouping
for 63 University of Wisconsin Students

I-E Score	Frequency	Cell Grouping
0	0	
1	2	
2	5	
3	2	Cell I (Internal)
4	2	n = 21
5	1	
6	3	
7	7	
8	2	
9	5	Cell II (Middle I-E)
10	5	n = 21
11	6	
12	5	
13	3	
14	5	
15	5	
16	2	
17	2	Cell III (External)
18	0	n = 21
19	1	
20	0	
21	0	
22	0	
23	0	

N = 63

Mean = 9.8
S.D. = 4.56

TABLE 2

Cell Means and Standard Deviations
on the Dependent Measures

Cell	Dependent Measure 1 Mean	S. D.	Dependent Measure 2 Mean	S. D.
Internal	.002156	.004517	.084196	.088662
Middle I-E	.003305	.003691	.092042	.090115
External	.005669	.006686	.129024	.126277

TABLE 3

Analysis of Variance of the First Dependent Measure:
Variance in Latency Accounted for by a Linear
Relationship between Latency and Item Difficulty

Source	d.f.	M. S.	F	
Between Groups	2			
Linear Trend	1	.0001	4.9391	*
Quadratic Trend	1	.0000	.1971	
Error	60	.000026		
Total	62			

* $p < .03$

TABLE 4

Analysis of Variance of the Second Dependent Measure: Variance in Latency Not Accounted for by a Linear Relationship between Latency and Item Difficulty

Source	d.f.	M. S.	F
Between Groups	2		
Linear Trend	1	.0211	1.9826
Quadratic Trend	1	.0030	.2792
Error	60	.0106	
Total	62		

FIGURE 1

Hypothesis 1: The Linear Relationship between Latency and Item Difficulty Will Be Strongest for Internals and Weakest for Externals

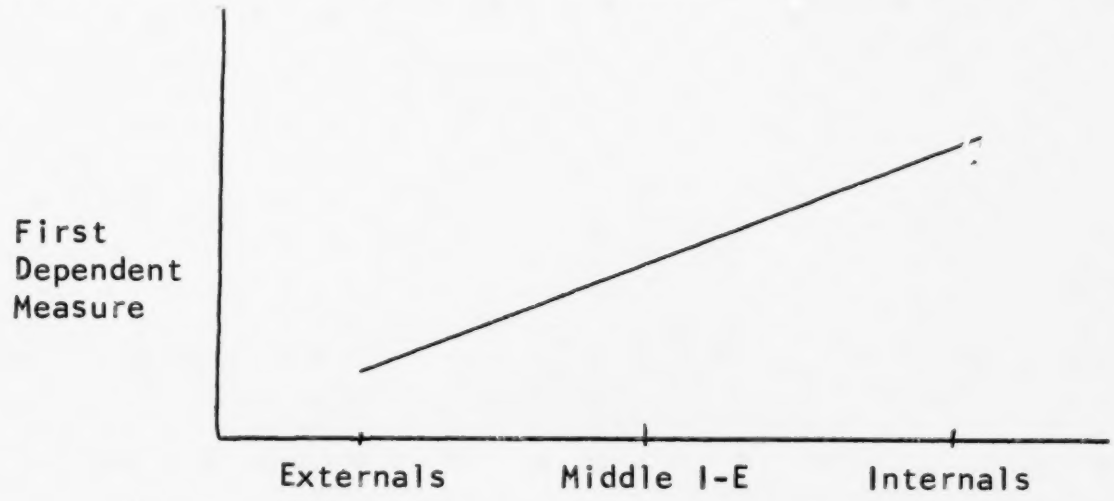

FIGURE 2

Hypothesis 2: The Non-linear Relationship between Latency and Item Difficulty Will Be Weakest for Internals and Strongest for Externals

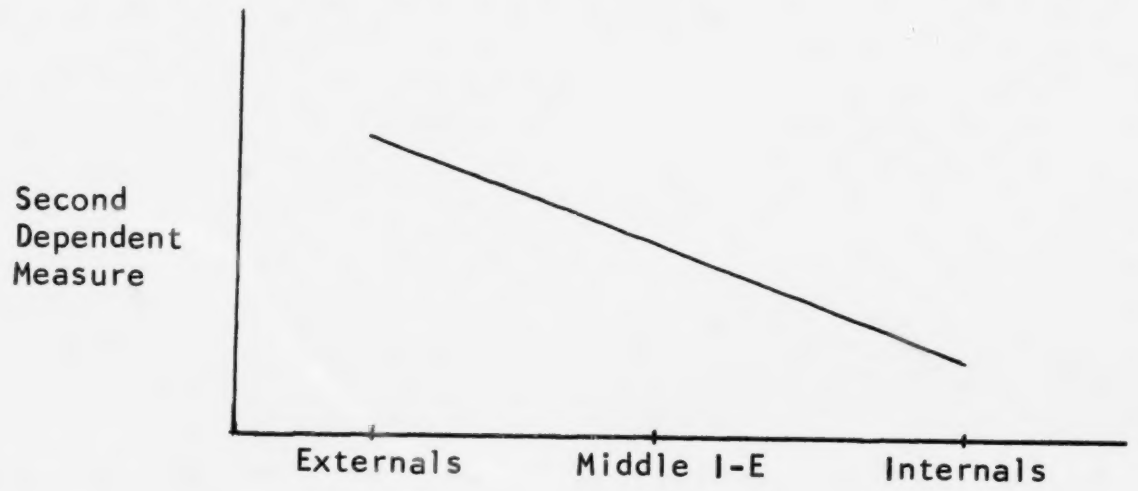

FIGURE 3

The Relationship between Latency and Item Difficulty for Individuals: Patterns That the Hypothesized Relationships Summarize

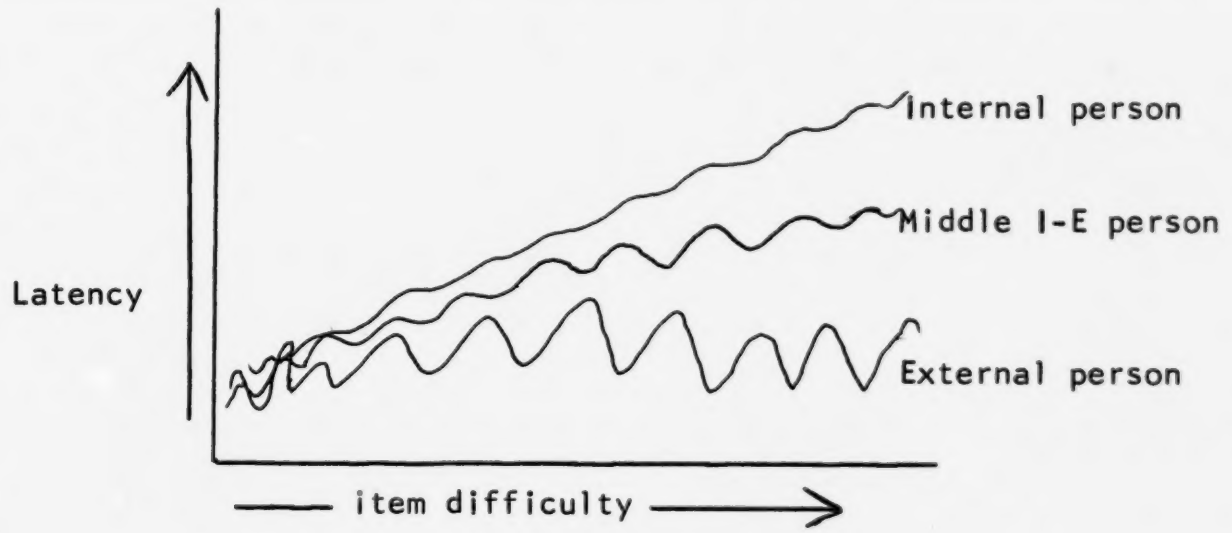

FIGURE 4

The Linear Relationship between Latency and Item Difficulty for Males, Females, and Combined Groups